accepted as the best expression of the conditions which affect the water relations of plants. Unfortunately, the soil moisture data are too scanty to afford a good basis for comparison, and are not expressed in terms indicating what proportion of this moisture is available for plant production. The temperature control has been experimentally studied for a few species, and the results have been previously reported.[4] These are given some further consideration, while slope exposure and topographic relief are carefully discussed. Perhaps nothing shows the unusual character of the factors controlling vegetation more than the fact that succession due to physiographic development and to the reaction of the plant upon its habitat is almost completely absent.

In its efforts to determine in a quantitative manner the climatic and other physical factors involved, and in its careful attempts to correlate these factors with vegetation, this report may be regarded as an excellent example of modern ecological investigation. The illustrations are numerous, well chosen, and reproduced in the excellent manner that has usually characterized the publications of the Carnegie Institution, while the organization of the material presented is decidedly better than that of many similar publications that have come to the attention of the reviewer.—GEO. D. FULLER.

Vegetation and tide levels.—The excellent opportunities for investigating the problems of seashore vegetation at Cold Spring Harbor, New York, afforded by the location at that place of the Biological Laboratory of the Brooklyn Institute of Arts and Sciences and the Carnegie Station for Experimental Evolution has been appreciated by many botanists, and the factors determining the composition and distribution of the various plant associations in the vicinity are becoming better known. In 1912 JOHNSON and YORK[5] made a preliminary announcement of the results of a survey of the inner harbor, and indicated the relations of the various plant associations to tide levels. This was followed by a more general paper by TRANSEAU[6] on the littoral successions of the vicinity, devoted principally to a consideration of the lines of succession followed by the seed plant communities from the salt marsh to the pine barrens. More recently there has come the full report of the careful survey of JOHNSON and YORK,[7] who have confined their attention to the vegetation of the inner harbor.

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[4] SHREVE, FORREST, Influence of low temperatures on the distribution of the giant cactus. Plant World **14**:136–146. 1911.

———, The rôle of winter temperatures in determining the distribution of plants. Amer. Jour. Bot. **1**:193–202. 1914; see review in BOT. GAZ. **59**:502–503. 1915.

[5] JOHNSON, D. S., and YORK, H. H., The relation of plants to tide levels. Johns Hopkins Univ. Circular no. 2. pp. 6. 1912.

[6] TRANSEAU, E. N., The vegetation of Cold Spring Harbor, Long Island. I. The littoral succession. Plant World **16**:189–210. *figs. 1–8.* 1913.

[7] JOHNSON, D. S. and YORK, H. H., The relation of plants to tide levels. Carnegie Inst. Wash. Publ. no. 206. pp. 162. *pls. 24. figs. 5.* 1915.

This body of water is separated from the larger outer harbor by a spit of sand and gravel. The shallowness of its water may be noted from the fact that its area of 110 acres at mean high tide is reduced to 45.5 acres with the 8-foot recession of the waters at mean low tide, while a further drop of 1 foot effects a further reduction to only 17 acres. The various levels were carefully marked by a large series of stakes set along the contour lines. In this way, using mean low water as zero, four vegetational belts were delimited: (1) the region of bottom vegetation from −3 to 1.5 feet, occupied by an algal association composed of *Ulva* and *Enteromorpha* together with an association of seed plants consisting of *Zostera marina* and *Ruppia maritima*, rooted in the muddy bottom; (2) the mid-littoral belt, from 1.5 to 6.5 feet, with the *Spartina glabra* marsh and the algal rockweed associations, the latter being dominated by *Fucus* and *Ascophyllum;* (3) the upper littoral belt, from 6.5 to 8 feet, with associations dominated by species of *Spartina*, *Juncus*, and *Scirpus;* and (4) the supra-littoral belt, from 8 to 12 feet, containing many species combined in intermingling associations.

In the careful analysis of many of the factors influencing the distribution of littoral plants, the substratum is found to consist of the lower stretches of a valley in glacial gravel and sand. The upper part of the valley is occupied by a small stream of fresh water flowing into the harbor, while in the harbor itself there is superimposed upon the gravel a black mud of varying depth, passing upward into a muddy peat formed by the remains of the salt marsh vegetation. The deposition of this peat is of such a character as to indicate comparatively recent coastal subsidence estimated at a minimum of 6 feet. Boulders of considerable size and the walls of wharves largely determine the horizontal limits of the rockweed association, while the larger plants act as the substratum for a varied epiphytic vegetation comprising most of the red algae; the abundant mussels are seen to be important in anchoring *Ulva* and *Enteromorpha clathrata*. Details of the interaction of the plant life and these substrata are rather carefully worked out.

Water currents due to tidal movements through the narrow channel at the end of the spit and to the inflowing stream of fresh water seem to be important in effecting distribution of the species, both through the transportation of the plants themselves, either broken or entire, and by the dispersal of seeds and spores. A secondary effect of currents is shown to be in changing the concentration of solutes about the plants themselves. Aeration is suggested as one of the important results, and further data are promised as to the distribution and effects of salinity. Tidal movements as effecting changes in water are the factor, or rather the complex of factors, given most attention, and an analysis is made of the character of the tides as related to (1) submergence and exposure, (2) evaporation, (3) aeration, (4) salinity of soil water, (5) effect on exposure to rain, and (6) effect on light supply. Many data are tabulated regarding the duration of submergence and exposure, and the ratio between the duration of the two is determined. The distribution

of the various plant associations agrees very closely in every instance with variations in this ratio, the vertical range of littoral species being strictly and sometimes very narrowly limited. Strangely enough, practically no species is found to be distributed, as so often reported, "between tide marks." The data upon the evaporative power of the air are scanty, only going to show that it is high, for as the atmometer readings were for a few hours of daylight only, no significant comparisons could be made with the data of other observers. Aeration due to tidal movements seems to be of some importance, while upon variation of salinity, the direct action of rain upon exposed vegetation, and the variation in light and their effects few exact data have been obtained as yet, but the careful study of the question of relative times of submergence and exposure has clearly defined many dependent problems for future investigation. This is perhaps the largest contribution from the careful and extended work of the authors.

Little less important than the careful analysis of the factors controlling the vegetation is the detailed study of the distribution both of the plant associations and of the species composing these associations. The results are expressed in several excellent vegetational maps of the entire harbor, of the sand spit, and of the estuarial marsh, together with belt transects on a large scale of the spit and the marsh. These provide a basis for future studies, two or more decades hence, that will certainly do much to give a better understanding of the causes and progress of plant succession in this and similar areas. The abundance of the data, the care with which they have been collected and arranged, the number of the maps, diagrams, and tables, and the organization of the discussion, are all matters to be highly commended. The deficiencies and omissions are such as are dependent upon the size of the problem and the multiplicity of the factors involved, rather than upon the neglect or oversight of the investigators, who are to be congratulated upon their patience and care in making so important a contribution to our knowledge of littoral vegetation.—GEO. D. FULLER.

Taxonomic notes.—BARTLETT[8] has described a new Mexican guayule, naming it *Parthenium Lloydii*, collected by LLOYD in Zacatecas.

DIXON[9] has described 10 new species of African mosses, one of which (*F. Wageri*) is made the basis of a new section of *Fabronia*. He also notes and discusses 21 additional rare species.

EVANS[10] has described a new species of *Metzgeria* (*M. grandiflora*) from the Galapagos Islands, included in a collection of liverworts made by ALBAN

[8] BARTLETT, H. H., *Parthenium Lloydii*, a new Mexican guayule. Torreya **16**:45–46. 1916.

[9] DIXON, H. N., New and rare African mosses, from MITTEN's herbarium and other sources. Bull. Torr. Bot. Club **43**:63–81. *pl. 1.* 1916.

[10] EVANS, A. W., A new species of *Metzgeria* from the Galapagos Islands. Torreya **16**:67–70. *figs. 5.* 1916.